

Claims

1. A method for the fabrication of a membrane (2) oriented in a (111) plane of a (100) silicon wafer (1), comprising the steps of:

- applying a masking layer (3) to both sides of the wafer (1), wherein portions (4) of the sides are covered by the masking layer (3); and
- the at least partial removal by etching away silicon material from the portions (5) of the two sides of the wafer (1) that are not covered,

10 **characterised** in that:

- the etching step substantially removes the silicon material forming recesses (6, 7) in the two surfaces of the wafer (1), such that the walls (8, 9, 10, 11) of the recesses (6, 7) are formed by (111) planes,
- 15 - not covered portions at both sides of the wafer are aligned in relation to one another such that a (111) plane (9 or 10) formed from a first side is oriented parallel to a (111) plane (10 or 9) formed from a second side, and the distance d between said two planes (9, 10) is less than the
- 20 thickness of the silicon wafer (1), so as to form a membrane (2) in the (111) plane having a thickness d, and
- at least one through-opening (12) is formed in the membrane (2) oriented in the (111) plane, with the opening (12) being oriented substantially perpendicularly in relation
- 25 to the (111) plane (9, 10).

2. A method according to claim 1, **characterised** in that into both sides of the wafer (2) V-shaped recesses (6, 7) are etched, wherein the lowest point in a V-shaped recess (6, 7) in a first side is positioned adjacent to a not

30 covered portion (5) at the other side of the wafer (1).

3. A method according to one of the preceding claims, **characterised** in that a recess (6, 7) in a first side reaches up to the masking layer (3) at the second side.

4. A method according to one of the preceding

35 claims, **characterised** in that the thickness d is measured and

the etching step is continued to etch the (111) planes (8, 9, 10, 11) until a desired thickness *d* is attained.

5 5. A method according to one of the preceding claims, **characterised** in that after the completion of the etching step the masking layer (3) is removed.

10 6. A method according to one of the preceding claims, **characterised** in that said step comprises providing an opening (12) that extends through the membrane (2) formed in the (111) plane, wherein the opening (12) extends from the free end (13) of the membrane (2) into the direction of a position (Z) where the membrane (2) is attached to the wafer (1).

15 7. A method according to one of the preceding claims, **characterised** in that the through-opening (12) is formed by an etching treatment, preferably by means of a dry-etching treatment, preferably a plasma etching treatment.

 8. A method according to one of the claims 1 to 6, **characterised** in that the through-opening (12) is formed by radiation with a high-energy source.

20 9. A method according to one of the preceding claims, **characterised** in that at least two parallel cuts (12) are formed, oriented substantially perpendicular in relation to the line where the formed membrane (2) is attached to the wafer (1), so as to form at least one cantilever (14).

25 10. A membrane (2) obtained by a method according to one of the claims 1 to 9.

 11. An application of a membrane according to claim 10 in a scanning element of a scanning element microscope, scanning probe microscope, or a friction force microscope.

30 12. An application of a membrane according to claim 10 in a mirror.

 13. An application of a membrane according to claim 10, wherein a first surface of the (111) plane forms a reflecting surface and the other surface comprises a position-modifying means.

35 14. An application of a membrane according to claim 10 in a microgrip, by positioning two membranes in a V-shape such that their ends (13) are oriented towards a mutual point

of intersection (S) and are placed at a distance from one another.

15 15. An application of a membrane according to claim 10 in a filter system, and provided with at least one opening (12).

10 16. An application according to claim 15, wherein at least one side of the wafer (1) is covered with a mask (15), wherein the recesses (6, 7) formed at both sides of the membrane (2) are in communication by means of the at least one opening (12).

15 17. An application of at least two membranes (2, 2') according to claim 10 arranged in a V-form in a positioning means (18), wherein at least one side of at least one of the membranes (2, 2') is provided with an actuator layer (22) for actuating the at least one membrane (2 or 2'), to allow an object on the membranes (2, 2') to be positioned in a predetermined manner.

20 18. An application of a membrane according to claim 10 in a microgripper as pick-and-place mechanism, for picking up objects to be handled, for manipulating and for moving them.

19. An application of a membrane according to claim 10, of which at least one surface is provided with a sensor layer (22), in a (bio)chemical sensor.

25 20. An application of a membrane according to claim 10 in a fuel cell, wherein on the membrane a first electrode is formed, electrically separated from a second electrode by an intermediate layer, and provided with openings to allow fuel to move from an outside of the first electrode to an outside of the second electrode.

21. An application according to claim 20, wherein the membrane is removed.

35 22. An application according to claim 20 or 21, wherein the intermediate layer is selected from the group comprising an electrolyte, for example, a solid oxide, a solid polymer, or a proton exchange membrane and a catalyst.

23. A method according to claims 1-9, **characterised** in that after the membrane (2) has been formed with thickness

d, a layer (16) is applied of a material that exhibits a different etching behaviour than silicon, whereafter the silicon material is at least partly etched away.

24. A method according to claim 23, **characterised**
5 in that the layer (16) of the material is applied over at least a portion of the silicon membrane's (2) surface.

25. A method according to claim 23 or 24,
characterised in that the material forming the layer (16) is
selected from silicon nitride, silicon oxide or silicon
10 carbide.

26. An application of a membrane obtained by the
method according to claim 23 or 24, wherein the layer (16) of
the material is electrically conductive and has an elongated
shape from a first connection point to a second connection
15 point, and forms a heating element, and is connected at the
two connecting points to a power source.